

## AbstractID: 3150 Title: Geometry Calibration of an On-Board kV Imaging System

**Purpose:** We have developed a method of geometrically calibrating the MV and kV radiographic isocenters of a Varian linear accelerator equipped with an on-board kV imaging system.

**Method and Materials:** The calibration uses a cylindrical phantom containing 16 BB's placed in a spiral pattern and ~400-600 radiographs of the phantom acquired using both kV and MV imaging systems. Since the phantom has a known geometry, the 7 degrees of freedom (DOF) needed to fit the predicted projections of the BB's to the measured projections can be calculated. During MV imaging a partial transmission plate is placed in the accelerator wedge slot to project a reference shape onto the EPID images of the phantom. The reference shape accounts for motion of the EPID and generates the radiographic isocenter for the MV x-ray beam alone. Geometry correction parameters can be calculated for the kV imaging system that map the center of radiographic images or CBCT projections to the radiographic isocenter of the MV beam. The method has been tested with linear accelerator and lab bench imaging systems.

**Results:** BB identification accuracy is ~0.3 pixels and is limited by noise in the images. While the method is insensitive to changes in SID (0.3 pixels ~ 2.5 cm SID change), the method can measure known in-plane imager displacements to an accuracy of better than 0.1 mm. Imager displacements versus gantry angle are small - 0.75x0.50 mm. CBCT reconstruction using parameters from this method results in spatial frequencies as high as 18 lp/cm and adjustments in parameters of  $\pm 0.1$  mm reduce the reconstructed spatial resolution.

**Conclusion:** Our method to match MV and kV radiographic isocenters for on-board imaging systems shows that accelerator flex is quite modest but that the calibration method can improve the spatial resolution of the CBCT reconstructions.